Abundance and Distribution of Bats in the Pryor Mountains of South Central Montana and North Eastern Wyoming

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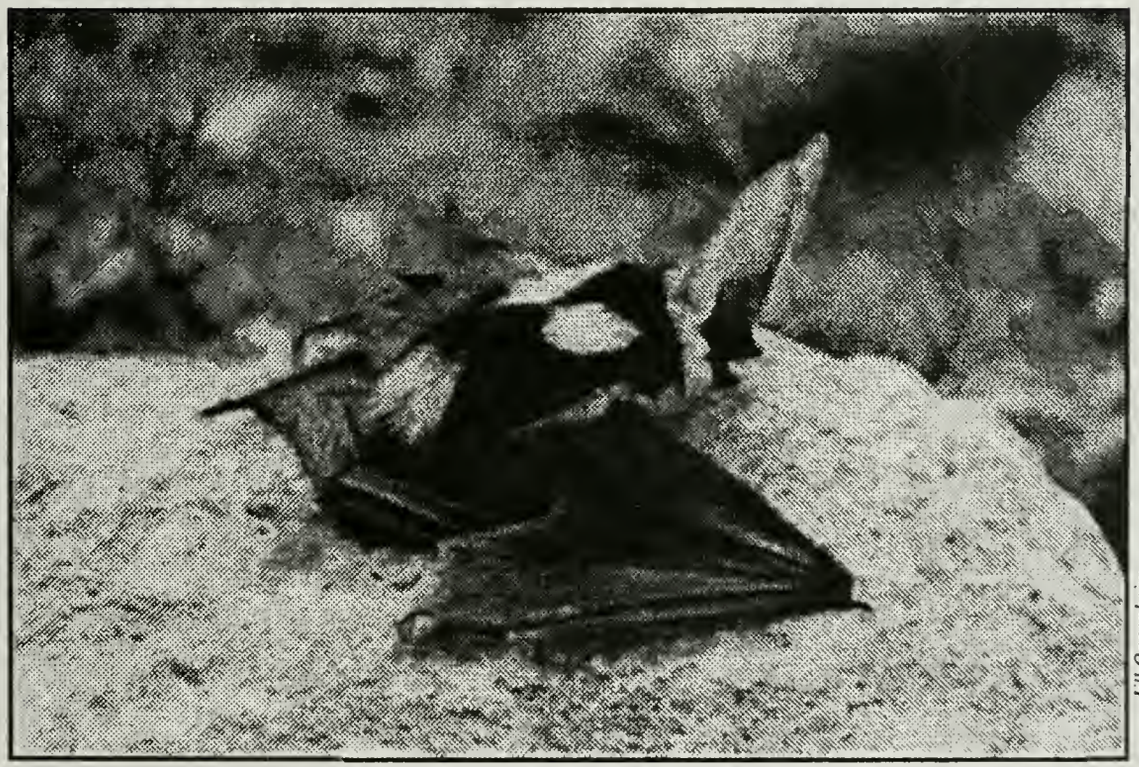

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Spotted Bat (*Euderma maculatum*)

for the

Montana Natural Heritage Program
Bureau of Land Management - Billings Resource Area
Custer National Forest

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Cover photo by Jill Oppenheim

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SUMMARY

This report documents the results of a study of bat occurrence in the Pryor Mountains of south central Montana that was initiated in 1989 (Worthington and Ross, 1990). The 1990 field research was conducted from 15 June to 14 September and resulted in a total capture of 1,101 individuals of 10 species. Bats were captured at ponds, springs, and at the entrance of five caves. Numbers of bats captured were generally greater at the caves. Capture success was considerably lower at water sources, but a greater diversity of species was noted at these sites. While several of the species captured occurred throughout the area, the spotted bat, Euderma maculatum, the pallid bat, Antrozous pallidus, and the silver-haired bat, Lasionycteris noctivagans, were more restricted in distribution. Two specimens of the spotted bat, Euderma maculatum, were captured. These specimens represent the first live spotted bats captured in Montana since 1949 (Nicholson, 1950; Hoffmann and Pattie, 1968). Spotted bats were observed throughout the eastern portion of the study area. Townsend's Big-eared bat, Plecotus townsendii, was previously known only from winter records in the Pryor Mountains; 11 individuals were observed in 1990. Seventeen individuals of Antrozous pallidus were captured, bringing to 26 the total number captured in the area since the species was first documented in Montana in 1979 (Shryer and Flath, 1980; Worthington and Ross, 1990). Several of the species of bats found in the Pryor Mountains were captured in numbers significantly different from an expected 1:1 sex ratio. This was especially true at the caves, where males greatly out-numbered females, suggesting that in some species males and females may be differentially utilizing habitat. The generally low temperatures of the caves investigated in this study may preclude their summer use by many female bats, especially pregnant or lactating individuals, which require higher roost temperatures in order to maintain the higher metabolic rate necessary for raising young (Racey, 1982). Bat activity at the caves, especially Mystery Cave, indicated that these caves provide important summer roosting habitat. Additionally, these caves possess characteristics which may make them important as hibernacula.

INTRODUCTION

Ten species of bats are known to inhabit the Pryor Mountain area (Hall, 1981; Shryer and Flath 1980; Hoffmann and Pattie, 1968; Table 1). Patterson (1985) captured a bat identified as Myotis californicus in the Bighorn Canyon National Recreation Area (NRA) in 1984. This specimen (University of Wyoming #5569) was recently re-examined, and is referable to Myotis ciliolabrum (M.A. Bogan, per. comm.). Two species, the spotted bat (Euderma maculatum) and Townsend's big-eared bat (Plecotus townsendii), are listed under category 2 as candidates for the Endangered Species Act (Federal Register, 1987). Plecotus townsendii and Euderma maculatum are listed as sensitive species by the Forest Service (USFS) in Region 1. The pallid bat, Antrozous pallidus, together with the previous two species, is listed as a species of special concern by the Montana Natural Heritage Program (MTNHP, 1990). The first specimen of Antrozous pallidus from Montana was collected by Shryer and Flath (1980). Eight additional specimens were observed in 1989 (Worthington and Ross, 1990) and 17 specimens were observed in 1990. Plecotus townsendii has been found in hibernacula during winter in the study area (D. Genter, per. comm.), and 11 specimens were observed in 1990. Two specimens of Euderma maculatum are known from the eastern edge of the Pryor Mountains in the Bighorn Canyon NRA (T. Peters, per. comm.), and the only live specimen was collected in Billings in 1949 (Nicholson, 1950; Hoffmann and Pattie 1968). Two specimens of Euderma maculatum were captured in the Big Horn Canyon National Recreation Area during the summer of 1990. Additionally, several individuals were heard throughout the eastern portion of the Pryor Mountains, particularly within the Bighorn Canyon NRA.

TABLE 1.--Bats Occurring in the Pryor Mountains.

Myotis lucifugus	little brown myotis
Myotis ciliolabrum	western small-footed myotis
Myotis evotis	long-eared myotis
Myotis volans	long-legged myotis
Eptesicus fuscus	big brown bat
Antrozous pallidus	pallid bat
Lasiurus cinereus	hoary bat
Lasionycteris noctivagans	silver-haired bat
Plecotus townsendii	Townsend's big-eared bat
Euderma maculatum	spotted bat

Tuttle and Stevenson (1978) suggest that those caves that possess structural and elevational complexity and a wide thermal range provide the greatest diversity of roosting sites. Tuttle (1979) found that of 1635 known caves in Alabama, only 2.4% were used by gray bats (Myotis griscens) in summer, and only .1% were used in winter. Larger, more complex caves may provide suitable roosting habitat for a diversity of species (Dalquest and Walton, 1970) and may provide sites for larger aggregations of these species (Kunz, 1982). While caves are numerous in the Pryor mountains, most are small and horizontal (Cambell, 1978). The few large caves found in the area may be of primary importance to bats, and were a primary focus of this study.

Of the many caves known in the area, one is known to have been used as a hibernaculum by Plecotus townsendii (D. Genter, per. comm), and two of the larger caves were found to be occupied by four species of Myotis during the summer of 1989 (Worthington and Ross, 1990).

This study was conducted largely to expand the base of information available on the species of bats occurring in the Pryor Mountains. The large number of caves in the area, combined with a diversity of habitats, together with information gathered from research conducted in 1989 (Worthington and Ross, 1990) and from previous studies, suggested that the Pryor Mountain area could support a large diversity of bat species, including those discussed above that are potentially rare. The information presented in this report provides additional information regarding the distribution, abundance, and ecology of these species. Such information is useful both from a scientific perspective, given that ecological information is very often lacking for the species considered in this study, as well as from a management perspective. The Federal Cave Resources Protection Act of 1988 mandates that federal agencies identify significant caves and manage for their protection. The caves discussed in this report may warrant such management. The two candidate species, together with Antrozous pallidus and the more abundant species, may require special management consideration. The information gathered from this study will assist the federal agencies involved in management of the Pryor Mountain area in making management decisions for bats as well as caves and their biological resources.

STUDY AREA

This study was conducted in the Pryor Mountains, approximately 72 km south of Billings, Montana. The area is primarily federal in ownership, and is administered by the Bureau of Land Management, the Custer National Forest, and the National Park Service. The Crow Indian Reservation borders the northern portion of the area, and small portions of private land are dispersed throughout the

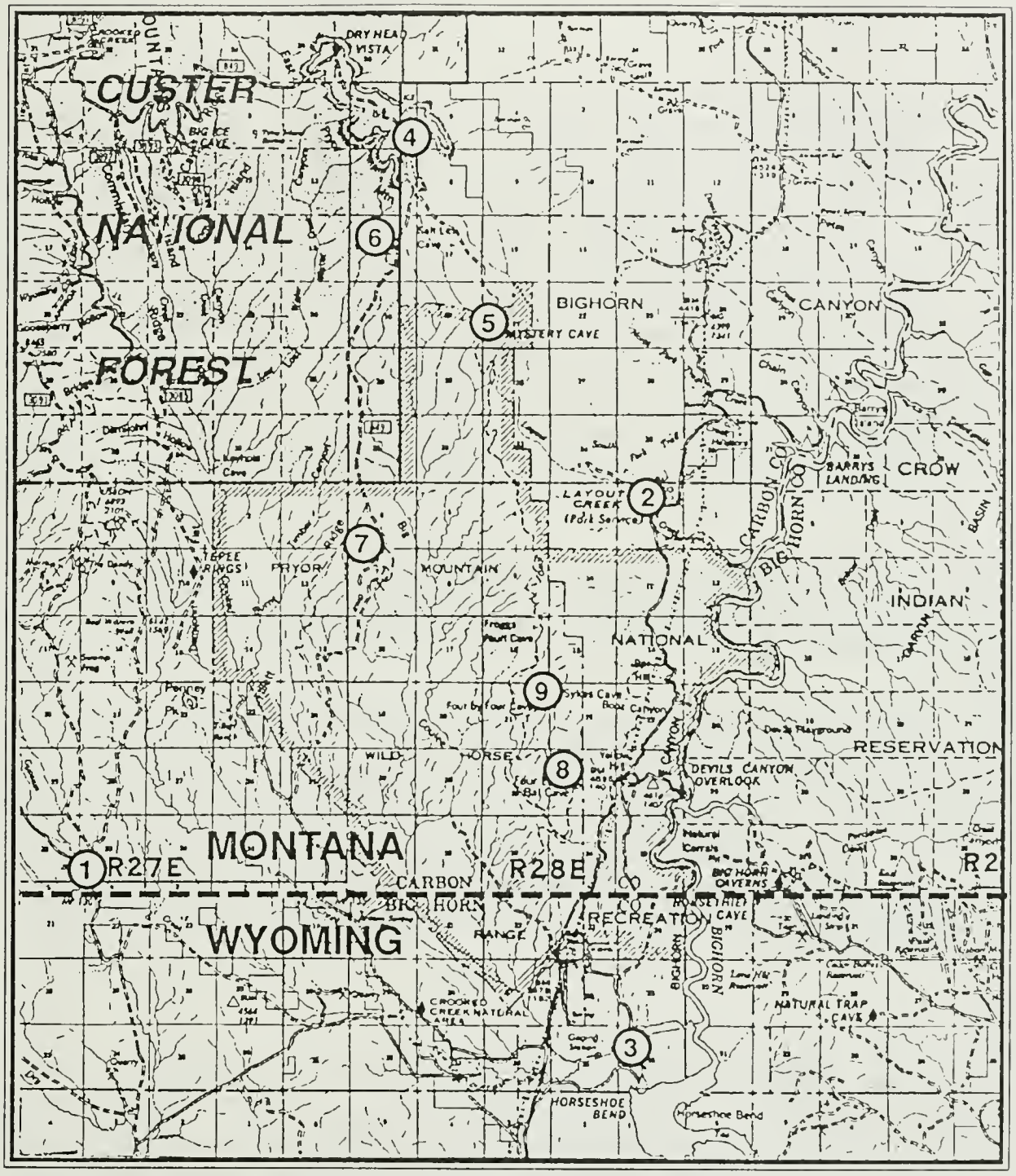
area. The area ranges in elevation from approximately 1100 m to over 2600 m, and encompasses approximately 500 square km. Nine terrestrial ecosystems have been described in the Pryor Mountains (South, 1980; Table 2), ranging from low elevation red desert salt shrub to subalpine plateau found at higher elevations. Vegetative and ecological descriptions in this report are based upon those descriptions.

TABLE 2.-- Terrestrial Ecosystems of the Pryor Mountains

1) Subalpine Plateau
2) Subalpine Forest and Meadow
3) Douglas Fir
4) Rock Outcrop
5) Mountain Grassland
6) Streamside Hardwood
7) Utah Juniper-Blacksage
8) Sagebrush-Grasslands
9) Red Desert Salt Shrub

METHODS

Bats are most successfully captured over calm water sources (Kunz and Kurta, 1988; von Frenckell and Barclay, 1987), especially over ponds or near the entrance of caves or mines used as roosting sites (Griffith and Gates, 1985). Water sources, caves, and mines were identified and located using US Geological Service (USGS) topographic maps, ground searches and "Caves of Montana" (Cambell, 1978). Most of these sites were chosen on the basis of preliminary work conducted in 1989 (Worthington and Ross, 1990). Bats were captured at water sources and caves using one or more 36 mm mesh mist nets 5.5, 9, or 13 m long. Additionally, a Tuttle trap (Tuttle, 1974; Kunz and Kurta, 1988) was frequently employed at the caves. Since bats may become more effective in avoiding nets on subsequent nights of trapping (Kunz, 1973; Laval, 1970; Kunz and Kurta, 1988), an attempt was made to avoid netting at the same site on two or more successive nights. Mist nets and/or the Tuttle trap were deployed shortly after sunset when bat activity commenced, and were either dismantled three to four hours later or left deployed through the night until dawn. Mist nets and/or the Tuttle trap were used at nine sites (Fig.1). Of these, four caves and two water sources were netted at least seven times each, with generally at least four days elapsing between visits. All captured bats were identified to species, and sex was determined by examination of external genitalia. Reproductive condition was assessed by external examination of the testes in males and visual examination of the mammary glands in females, although pregnancy was not determined (Racey, 1988).



1. Gyp Spring
2. Layout Creek
3. Horseshoe Bend Campground
4. Kruger Pond
5. Mystery Cave
6. Little Ice Cave
7. Royce Cave
8. Four-eared Bat Cave
9. Syke's Cave

Figure 1. Sites investigated

All adult males in this study exhibited small testes size, and were considered to be non-scrotal. Adult females that possessed mammary glands which were swollen or from which milk could be exuded were considered lactating. Adult females that possessed mammary glands around which hair was lacking but which were not swollen were considered post-lactating, and females that possessed mammary glands around which hair was present were considered non-lactating. Bats were classified as adults or juveniles based upon the degree of epiphyseal-diaphyseal fusion of wing bones (Anthony, 1988). A bat was considered to be a juvenile if the epiphyseal-diaphyseal fusion of the bat's back-lighted wing appeared to be incomplete. Body mass was determined by placing bats in a small plastic bag and weighing them using a 50 gm Pesola scale. Forearm length was measured using vernier calipers. Most bats were marked using color and number coded split-plastic wingbands (Barclay and Bell, 1988) to facilitate identification upon recapture.

Caves at which bats were captured were also entered in order to record temperature and humidity and to describe structural characteristics. Additionally, several abandoned uranium mines along the Red Pryor Mountain Road were entered and temperature recorded.

Special efforts were placed on locating Euderma maculatum and Plecotus townsendii. Trapping continued at three sites where capture success was otherwise low in an attempt to capture these species. In addition to trapping efforts, aural monitoring was conducted in an attempt to locate Euderma maculatum. This is the only species of bat in the study area that possesses an echolocation call audible to the unaided ear (sensu Fenton et al., 1984) and was easily identifiable. Monitoring for Euderma maculatum was conducted primarily within the Bighorn Canyon NRA.

RESULTS

Bats were captured at five caves and four water sources. These sites were investigated on 50 nights between 22 June and 11 September 1990. Additionally, nine mines and the five caves were entered and temperature and humidity recorded. A total of 1,101 bats were captured representing ten species (Table 3). Of 1,079 bats marked (273 in 1989, 806 in 1990), 86 individual bats were recaptured, representing 98 total recaptures. Of the total, 38 (39%) recaptures represent bats marked in 1989, the remaining 60 (61%) having been marked during 1990. All of the recaptures occurred at one of four caves: Mystery, Little Ice, Royce, and Four-eared. Only one recapture represented a bat that had moved between caves, a male long-eared myotis, Myotis evotis, that was captured at Little Ice Cave in 1989 and recaptured twice in 1990 at Royce Cave.

The uranium mines that were entered varied considerably in depth from approximately 50 m to more than 300 m (the long tunnels were not explored beyond this depth). Temperatures ranged between 4.4° C and 9° C. Humidity was not recorded, but all of the tunnels, especially the deeper shafts, were very damp and probably had humidities approaching 100%. Few crevices and cracks were apparent in these shafts, likely making them unsuitable for most species of bats. However the tunnels were similar in structure to tunnels where the Townsend's big-eared bat has been found (per. obs.). One adult male Townsend's big-eared bat was found roosting in one of the shallow (100 m) tunnels. This individual represented the only sign of bats found in these mines.

Additionally, one adult male Townsend's big-eared bat was located roosting in an abandoned building on private land just west of Horseshoe Bend Campground.

TABLE 3.-- All Bat Captures, 1990

Species	Males	Females	Total
Myotis lucifugus	530	53	583
Myotis ciliolabrum	52	14	66
Myotis volans	185	23	208
Myotis evotis	112	62	174
Lasiurus cinereus	3	1	4
Eptesicus fuscus	32	1	33
Lasionycteris noctivagans	2	1	3
Antrozous pallidus	8	9	17
Plecotus townsendii	6	5	11
Euderma maculatum	-	2	2
Total	930	171	1,101

Trapping success was generally greater at the caves, where 960 (87%) bats were captured in 30 nights of trapping. Considerably fewer bats were captured at water sources: 143 (27%) on 20 nights of trapping. However, species diversity tended to be greater at the water sources, and neither the pallid bat, spotted bat, silver-haired bat, nor the hoary bat occurred at the caves. Conversely, only one species, the Townsend's big-eared bat, occurred at the caves but was not observed at the water sources. Three species of the genus Myotis were most abundant at the caves, but relative proportions of these species varied between caves, and Plecotus townsendii and Eptesicus fuscus did not occur at all caves. At both Mystery Cave and Little Ice Cave, where the most bats were captured (892, 81%), as well as Syke's Cave, only species of the genus Myotis were captured (with the exception of one Plecotus townsendii captured at Mystery Cave).

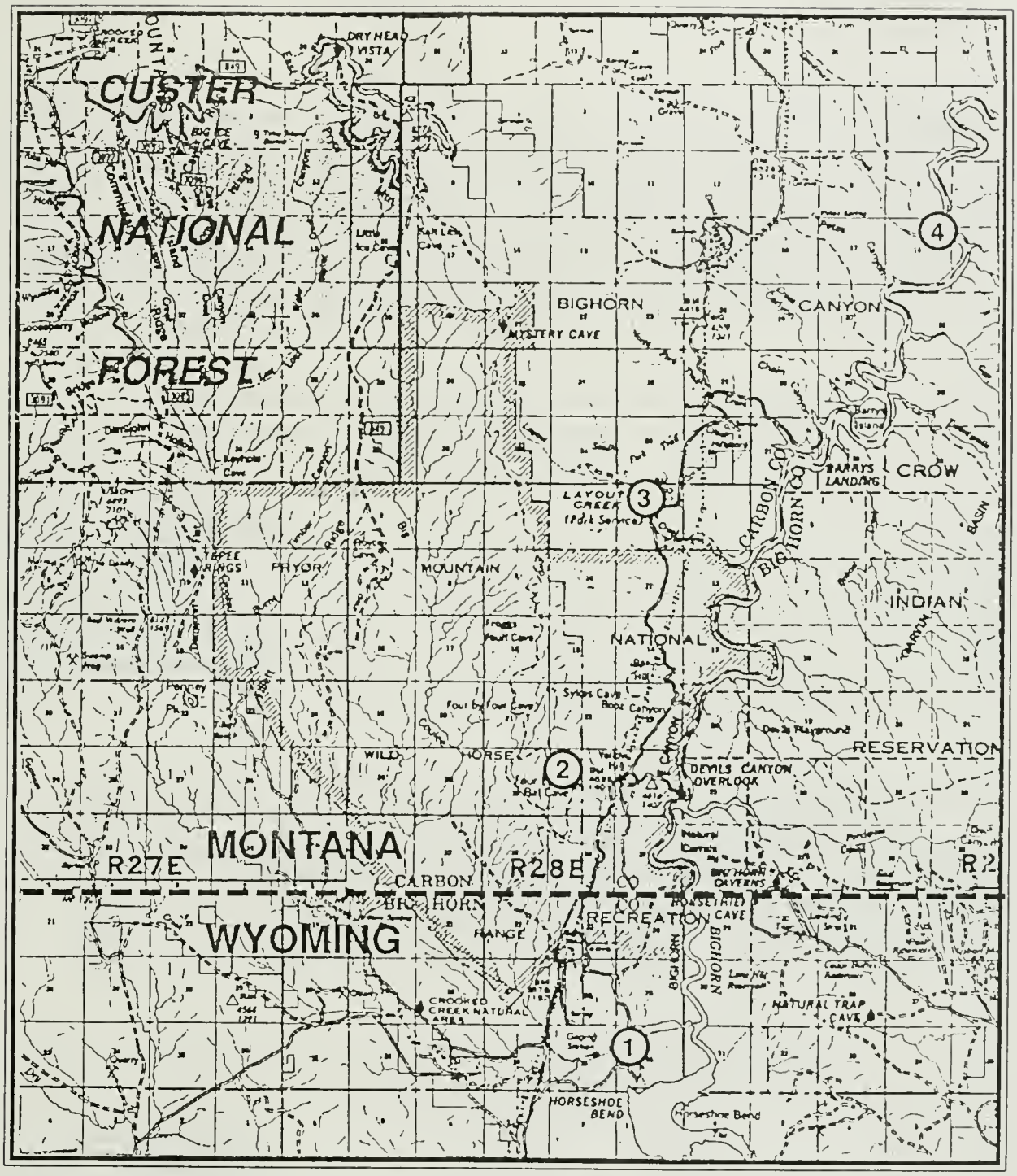
In addition to the two specimens captured in nets, spotted bats were heard on 9 nights at 4 different locations (Fig. 2). These bats were heard between 2100 hrs and 0100 hr. On several occasions, bats passed over more than once, but it was not possible to determine if this represented more than one bat or a single individual passing through the area more than once. The exception to this was when two bats were observed simultaneously at the sewage lagoon on 29 June.

WATER SOURCES

Gyp Spring (T. 9 S., R. 27 E., Sec. 33, Carbon Co., MT; elevation: 1400 m) is located on BLM land approximately 1 km north of the Wyoming border at the intersection of the Helt and Gyp Spring roads. The spring was netted seven times between 24 June and 9 September. The area surrounding the spring is characterized by 10 m high red-sandstone outcrops. The vegetation surrounding the spring is representative of the Utah juniper-blacksage ecosystem. Bat species diversity was moderate at this site, and relatively few bats were captured. However, nine female Antrozous pallidus were captured at this site (Table 4). Netting was done at the head of the spring.

TABLE 4.--Bats captured at Gyp Spring

Species	Males	Females	Total
Myotis ciliolabrum	18	7	25
Myotis volans	2	-	2
Lasiurus cinereus	2	-	2
Eptesicus fuscus	1	-	1
Antrozous pallidus	-	9	9
Total	23	16	39



LOCATION	DATE
1. Horseshoe Bend Campground	29 June
2. Four-eared Bat Cave	30 July, 6 Aug., 5 Sept.
3. Layout Creek	12, 26 July & 16, 17 Aug.
4. Deadman's Creek inlet Bighorn River	13 Sept.

Figure 2. Location of Spotted Bat (Euderma maculatum) Observations

Layout Creek Ranger Station (T. 9 S., R. 28 E., Sec. 2, Carbon Co. MT; elevation: 1300 m) is located in the south district of the Bighorn Canyon NRA approximately 13 km north of the Wyoming border. A one-half acre pond at this site was netted seven times between 30 June and 4 September, and was the only location where Euderma maculatum was captured (Table 5). An adult female was captured on 26 July and a juvenile female was captured on 16 August. The juvenile specimen was collected (University of Montana Zoological Museum # 17504).

Table 5.--Bats Captured at Layout Creek Ranger Station.

Species	Males	Females	Total
Myotis lucifugus	3	-	3
Myotis ciliolabrum	2	2	4
Myotis volans	-	1	1
Myotis evotis	-	1	1
Eptesicus fuscus	9	-	9
Antrozous pallidus	4	-	4
Euderma maculatum	-	2	2
Total	18	6	24

The sewage lagoon (T 58 N., R. 95 W. Sec. 36, Bighorn Co., WY. Elevation: 1100 m) is a small asphalt-lined pond near the **Horseshoe Bend Campground** in the Bighorn Canyon NRA. This pond is surrounded by sagebrush grassland and red-desert salt shrub, and was netted three times between 29 June and 27 August (Table 6). While no specimens of Euderma maculatum were captured here, they were observed in the area on several occasions (Fig. 2).

TABLE 6.-- Bats Captured at Horseshoe Bend Campground

Species	Males	Females	Total
Myotis lucifugus	2	9	11
Myotis ciliolabrum	-	1	1
Lasiurus cinereus	1	1	2
Eptesicus fuscus	3	1	4
Lasionycteris noctivagans	2	1	3
Antrozous pallidus	4	-	4
Total	12	13	25

Kruger Pond (T. 8 S., R 28 E., Sec. 8, Carbon Co., MT. Elevation: 2400 m) is located in an opening of subalpine meadow

surrounded by Douglas-fir forest. This small pond (approximately one-half acre) was netted once on 13 August (Table 7).

TABLE 7.-- Bats Captured at Kruger Pond.

Species	Males	Females	Total
Myotis ciliolabrum	3	-	3
Myotis evotis	1	1	2
Myotis volans	-	2	2
Eptesicus fuscus	6	-	6
Total	10	3	13

CAVES

Bats were captured at five caves. Four of the caves, Mystery, Little Ice, Four-eared, and Royce, were trapped at least seven times, while Syke's Cave was trapped only once. Measurements taken in the caves indicated that temperature and humidity remain constant both within a 24 hour period and between the months of June and September. All of the caves were entered on at least three occasions, but no bats were observed roosting.

Mystery Cave (T. 8 S., R. 28 E., Sec. 21, Carbon Co., MT; elevation: 2384 m) is located near the south end of East Pryor Mountain on BLM land in Douglas-fir forest. The entrance is approximately 4 m wide and 2 m high with an aspect of approximately 75°. This extensive cave extends over 500 m in depth and possesses many interconnecting passages and rooms. The cave temperature is approximately 3.3° C. The cave is very damp (100% humidity), with running water and small pools present. Over 700 bats were trapped at this cave on eight nights between 23 June and 8 September (Table 8).

TABLE 8.--Bats Captured at Mystery Cave.

Species	Males	Females	Total
Myotis lucifugus	433	38	471
Myotis ciliolabrum	5	-	5
Myotis volans	132	18	150
Myotis evotis	63	21	84
Plecotus townsendii	-	1	1
Total	633	78	711

Little Ice Cave (T. 8 S., R. 28 E., Sec. 18, Carbon Co., MT; elevation: 2494 m) is located in Douglas-fir forest on USFS land

about 3 km northwest of Mystery Cave. Little Ice Cave is similar in the fractured rock and sinuous character of Mystery Cave, although it lacks the large chambers characteristic of Mystery Cave. Little Ice Cave is cool (approximately 3.3° C throughout) with 100% humidity, although running and standing water was not as apparent as in Mystery Cave. The first 16 m beyond the 3 m X 3 m entrance (aspect 220°) are ice covered year round (Cambell, 1978). This cave has several levels, and like Mystery Cave, possesses many crevices where bats could roost. One hundred seventy-four bats were captured at Little Ice Cave on seven nights between 25 June and 11 September (Table 9).

TABLE 9.--Bats Captured at Little Ice Cave.

Species	Males	Females	Total
Myotis lucifugus	89	6	95
Myotis volans	48	2	50
Myotis evotis	18	10	28
Myotis ciliolabrum	1	-	1
Total	156	18	174

Royce Cave (T. 9 S., R 28 E., Sec. 6. Elevation: 1878 m) is located approximately 16 km south of Dry-Head overlook on Tillet Ridge Road in rock outcrop forest. The cave's entrance (aspect 180°) is small (approximately 2m X 2m) and lies at the bottom of large collapsed sink. A 30 m tunnel leads to a 25 m X 30 m chamber. This cave was fairly warm (8.9° C) and the humidity was 100%. Seventy-five bats were captured here on seven nights between 26 June and 9 September (Table 10).

TABLE 10.--Bats Captured at Royce Cave

Species	Males	Females	Total
Myotis lucifugus	2	-	2
Myotis ciliolabrum	6	-	6
Myotis volans	3	-	3
Myotis evotis	29	29	58
Plecotus townsendii	3	2	5
Eptesicus fuscus	1	-	1
Total	44	31	75

Four-eared bat Cave (T. 9 S., R. 28 E., Sec. 27, Carbon Co., MT; elevation: 1537 m) is located on an arid ridge of Utah juniper-blacksage on BLM land. Plecotus townsendii has used this

cave as a winter hibernaculum, and several specimens of this species were captured here in 1990. Four-eared Bat Cave is less extensive than either Little Ice Cave or Mystery Cave, with two large rooms extending inward approximately 70 m from the 2 m by 6 m entrance (aspect 225°), and the cave is dryer and warmer (approximately 8.8° C with 73% humidity). This cave was trapped seven times between 22 June and 9 September, and 32 bats were captured (Table 11).

TABLE 11.--Bats Captured at Four-eared Bat Cave.

Species	Males	Females	Total
Eptesicus fuscus	12	-	12
Myotis ciliolabrum	14	3	17
Plecotus townsendii	1	2	3
Total	27	5	32

Syke's Cave (T. 9 S., R. 28 E., Sec. 22. Elevation: 1738 m) is located approximately 3 km north of Four-eared Bat Cave on a steep ridge in Utah juniper blacksage. The cave is similar in structure to Royce Cave, consisting of a 30 m diameter chamber leading to a 3 m X 2 m entrance (aspect 135°) via a 10 m tunnel. This cave was dryer and warmer than the other caves with a temperature of 13° C and a humidity of 57%. This cave was trapped once on 6 August (Table 12).

TABLE 12.--Bats Captured at Syke's Cave

Species	Males	Females	Total
Myotis lucifugus	1	-	1
Myotis ciliolabrum	3	1	4
Myotis evotis	1	-	1
Total	5	1	6

DISCUSSION AND RECOMMENDATIONS FOR FURTHER WORK

The capture of both a lactating female and a juvenile spotted bat in mid-July suggests that this species probably breeds in the area. Spotted bats were observed throughout the southern portion of the Bighorn Canyon NRA, suggesting that they may be fairly widespread in the southern portion of the NRA.

Unlike the spotted bat, the Townsend's big-eared bat's call is inaudible to the unaided human ear, and it is not easily distinguishable from other bats with electronic bat detectors. Also, the energy level of this bat's call is relatively low. Thus aural monitoring was not practical for this species. However, the observation of 11 individuals in 1990 confirms the summer occurrence of this species in the study area. One of the specimens captured was a juvenile, suggesting that this species breeds in the area. During the summer, this species may roost in a variety of locations, ranging from abandoned buildings to caves or abandoned mines (Kunz and Martin, 1982). Individuals may be spread out, and it may be difficult to locate a significant number of individuals to determine abundance, especially if population numbers are small. This species tends to favor roosting near the entrances of mines and caves for hibernation (Humphrey and Kunz, 1977; per. obs.) and tends to remain in the same area throughout the year (Kunz and Martin, 1982). Therefore, examination of potential hibernation sites may be an effective means of determining the abundance of this species in the area.

The capture of 17 additional pallid bats, including several lactating females and juveniles, suggests that they breed in the area. This species was encountered frequently at the sites where it was captured, and it seems likely that this species may be locally common in the area.

It would be particularly desirable to continue work on the two candidate species under consideration for listing by the U.S. Fish and Wildlife Service, Euderma maculatum and Plecotus townsendii. In the case of the spotted bat, additional work could take several directions. Wai-Ping and Fenton (1989) have successfully radio-tagged this species in order to obtain information on foraging and roosting areas and habits. Such a program could be undertaken in the Bighorn Canyon NRA and surrounding area in order to identify significant areas of usage by this species. Such research would be labor intensive and costly however. A more immediate concern should probably be the identification of the distribution pattern of this species. An examination by boat of the Bighorn Canyon between Barry's Landing and Big Elk Creek to the north revealed potential spotted bat habitat. The area is characterized by high (300 m) cliffs and is similar to habitat described by Woodsworth et al., (1981) and Watkins (1977). Monitoring throughout the area, including spending a significant amount of time in the canyon, would provide information on this species' distribution and habitat use throughout the area.

Only a gross description of cave structure was possible in this study, and the descriptions of Cambell (1978) are limited. During the summer of 1991, a caving group associated with Washington State University is planning to do extensive mapping

and descriptive work on the caves in the Pryor Mountain area. The information derived from this project (e.g., more complete temperature and humidity readings throughout the caves, as well as more precise descriptions of cave structure) could provide information on potential cave microhabitats that bats may be using differentially, but were not possible to identify in this study. It would be advantageous for this group to work closely with the U.S. Forest Service and Bureau of Land Management.

Mystery Cave has been gated in order to prevent unauthorized access. The U.S. Forest Service and the Bureau of Land Management may wish to consider gating other caves occurring on their lands. This is particularly important in light of efforts by these agencies to increase access and visitation to the area by the public. Gating would assist in preserving the biological, archaeological, and geological integrity of the caves in the Pryor Mountains. It may be especially important for caves that are occupied by the Townsend's big-eared bat, such as Four-eared Bat Cave and Royce Cave. This species generally roosts in the open and is particularly susceptible to disturbance (Humphrey and Kunz, 1976; Kunz and Martin, 1982; Genter, 1986; 1989) and may abandon caves when disturbed.

All of the caves investigated in 1990 appear to be important summer habitat for bats. It should be determined if use of these caves by bats is continuous or seasonal. It would therefore be desirable to visit these caves during the winter to determine if bats use the caves as hibernacula. Very little is known about the wintering habits of bats in Montana, and in the case of Myotis evotis, nothing is known about its hibernating habits throughout its range (Manning and Jones, 1989). All of the caves investigated possess characteristics of hibernacula, including numerous crevices and fractures where bats may roost, as well as cold temperature and high humidity (Raesly and Gates, 1987; Tuttle and Stevenson, 1978). Of these, Mystery Cave and Little Ice Cave may have the greatest potential as hibernacula. These two caves are large and complex, and possess high humidity and cold temperatures, making them potentially ideal hibernacula. In three species (Myotis volans, Myotis lucifugus, and Myotis evotis), differential captures of males and females suggested differential habitat use. At both Mystery Cave and Little Ice Cave, males of all three of these species are more numerous than females (Tables 8-9). At Royce Cave, Myotis evotis was the predominant species, and numbers of males and females captured were nearly identical (Table 10). The cool temperature of both Mystery Cave and Little Ice Cave may preclude the use of these roosts by female bats during the summer (Kunz, 1982; Anthony et al., 1981) although females may occur in larger numbers during winter. Royce Cave's slightly higher temperature may account for the greater number of females at this location.

The author was surprised by the lack of movement of bats between caves. While Mystery Cave and Little Ice Cave are approximately 3 km apart, no bats were found to move between these two roosting sites, either during 1990 or between 1989 and 1990. It therefore appears that in this study, bats maintain seasonally distinct roosts. It is not certain that this separation is maintained year round. However, since bats captured at one cave in 1989 were not found at the other in 1990, it is possible that the populations at each of these caves may be reproductively isolated. Further investigation with banded individuals is necessary to address this possibility. Species composition varied from cave to cave. At both Mystery Cave and Little-ice Cave, the little-brown bat was the most common species encountered, accounting for over 50% of captured bats. At Royce Cave, the little-brown bat accounted for only 2% of captured bats, while the long-eared myotis accounted for nearly 80%. At both Royce Cave and Four-eared Bat Cave, numbers of bats captured were low compared to Mystery Cave and Little Ice Cave, but these were the two sites where the Townsend's big-eared bat was most frequently encountered. The differences in species composition could be due to differences between the caves (e.g. size, structure, temperature, or humidity), by the habitat in which a cave occurs, or by a combination of these factors. Thus while Mystery cave was most productive in terms of numbers of bats captured, followed by Little Ice Cave, the conservation of bats in all of the caves investigated in this study may be important in maintaining a diversity of bat species in the Pryor Mountains.

The caves investigated in this study do not represent all of those in the Pryor Mountain area. Frogg's Fault Cave, for example, is very extensive, but is vertical in nature and requires technical equipment to enter. Several caves in the western portion of the area were not investigated, and may represent important bat habitat.

While not entirely complete in its inventory of potential cave habitat in the Pryor Mountains, this study does indicate that the area is inhabited by a bat fauna of significant diversity (10 of the 14 species known to occur in Montana are represented) and suggests that cave management in the Pryor Mountains could have a significant impact on these species. Conservation of these caves is likely to be extremely important in maintaining both the numbers and species diversity of bats in the Pryor Mountains.

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